

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Currently amended) A method for controlling on/off states of an engine in a hybrid electric vehicle powertrain, the method comprising the steps of:

generating a plurality of request state variables based on a comparison of vehicle operating conditions and requirements, each variable indicating an active or inactive status of a plurality of engine requests;

prioritizing the active request state variables according to a predetermined schedule;

selecting at least two active request state variables of higher priority than other request state variables in the plurality of request state variables;

combining the at least two request state variables to form a combined request state variable that contains active requests in the at least two request state variables;

simplifying the combined request state variable to eliminate any redundant requests and to resolve any conflicting requests;

providing a final request state variable; ~~and~~

evaluating the final request state variable to determine whether a change in engine state is desirable;

the step of evaluating the final request state variable comprising:

transitioning a state machine from an engine on state to an engine off state in accordance with a first predetermined relationship of engine request variables fpu, pu, ipu and fpd and otherwise maintaining the state machine in an engine on state; and

transitioning the state machine from an engine off

state to an engine on state in accordance with a second predetermined relationship of engine request variables fpu, pu, ipu and fpd and otherwise maintaining the state machine in an engine off state, where fpd, pd, fpu, ipd, pu and ipu are engine request variables, which identify the active or inactive status of engine requests.

2. (Cancelled)

3. (Currently amended) The method of Claim 1 [[2]] wherein the step of combining joins two or more request states through a bitwise OR operation.

4. (Original) The method of Claim 3 wherein the step of simplifying includes an arbitration operation that follows the requests according to a predetermined priority.

5. (Currently amended) The method of Claim 1 [[2]] wherein said engine requests are grouped in hierarchical levels through the combining and simplifying steps.

6. (Currently amended) ~~The method defined in Claim 2 wherein~~ A method of controlling the on/off state of an engine in a hybrid electric vehicle powertrain comprising the following steps:

generating a plurality of request state variables based on a comparison of vehicle operating conditions and requirements, each variable indicating the active or inactive status of each of a plurality of engine requests, the value of each request state variable being constrained to a set of fundamental request states;

prioritizing the active request state variables according to a predetermined schedule;

selecting at least two active request state variables

of higher priority than other request state variables in the plurality of request state variables;

combining at least two request state variables to form a combined request state variable that contains active requests in the at least two request state variables;

simplifying the combined request state variable to eliminate any redundant requests and to resolve any conflicting requests;

providing a final request state variable; and
evaluating the final request state variable to determine whether a change in engine state is desirable;

the step of evaluating the final request state variable includes the step of:

transitioning a state machine from an engine off state to an engine on state in accordance with the following expression:

$$(fpu + pu \cdot \overline{ipu}) \cdot \overline{fpd}$$

where fpu, pu, ipu and fpd are engine request variables identifying the active or inactive status of engine requests.

7. (Currently amended) The method of Claim 6 [[2]] wherein each fundamental request state comprises a 6 bit binary word, each bit identifying whether an engine request state is active or inactive.

8. (Currently amended) A method of controlling the on/off state of an engine in a hybrid electric vehicle powertrain comprising the following steps:

generating a plurality of request state variables based on a comparison of vehicle operating conditions and requirements, each variable indicating the active or inactive status of each of a plurality of engine requests, the value of each request

state variable being constrained to a set of fundamental request states;

prioritizing the active request state variables according to a predetermined schedule;

selecting at least two active request state variables of higher priority than other request state variables in the plurality of request state variables;

combining at least two request state variables to form a combined request state variable that contains active requests in the at least two request state variables;

simplifying the combined request state variable to eliminate any redundant requests and to resolve any conflicting requests;

providing a final request state variable; and
evaluating the final request state variable to determine whether a change in engine state is desirable;

~~The method defined in Claim 2 wherein~~ the step of evaluating the final request state variable ~~includes~~ including the step of: transitioning a state machine from an engine on state to an engine off state in accordance with the following expression:

$$fpd + pd \cdot \overline{fpu} \cdot \overline{ipd} \cdot \overline{pu} ,$$

where fpd, pd, fpu, ipd, and pu are engine request variables identifying the active or inactive status of engine requests.

9. (Currently amended) A method of controlling the on/off state of an engine in a hybrid electric vehicle powertrain comprising the following steps:

generating a plurality of request state variables based on a comparison of vehicle operating conditions and requirements, each variable indicating the active or inactive status of each

of a plurality of engine requests, the value of each request state variable being constrained to a set of fundamental request states;

prioritizing the active request state variables according to a predetermined schedule;

selecting at least two active request state variables of higher priority than other request state variables in the plurality of request state variables;

combining at least two request state variables to form a combined request state variable that contains active requests in the at least two request state variables;

simplifying the combined request state variable to eliminate any redundant requests and to resolve any conflicting requests;

providing a final request state variable;

evaluating the final request state variable to determine whether a change in engine state is desirable;

~~The method defined in Claim 2 wherein~~ the step of evaluating the final request state variable ~~includes~~ including the steps of:

transitioning a state machine from an engine on state to an engine off state in accordance with the following expression:

$$fpd + pd \bullet \overline{fpu} \bullet \overline{ipd} \bullet \overline{pu}$$

and otherwise maintaining the state machine in an engine on state; and

transitioning said state machine from an engine off state to an engine on state in accordance with the following expression:

$$(\overline{fpu} + pu \bullet \overline{ipu}) \bullet \overline{fpd}$$

and otherwise maintaining the state machine in an engine off

state[[]] where fpd, pd, fpu, ipd, pu, and ipu are engine request variables identifying the active or inactive status of engine requests.

10. (Original) The method of Claim 8 wherein each fundamental request state comprises a 6 bit binary word, each bit identifying whether an engine request state is active or inactive.

11. (Original) The method of Claim 9 wherein the step of combining joins two or more request states through a bitwise OR operation.

12. (Original) The method of Claim 10 wherein the step of simplifying includes an arbitration operation that follows the requests according to a predetermined priority.

13. (Original) The method of Claim 11 wherein the engine requests are grouped in hierarchical levels through the combination and simplification steps.

14-18. (Cancelled)

19. (Currently amended) A method of controlling the on/off states of an engine in a hybrid electric vehicle powertrain comprising the following steps:

generating a plurality of request state variables based on a comparison of vehicle operating conditions and requirements, each variable indicating the active or inactive status of each of a plurality of engine requests, the value of each request state variable being constrained to a set of fundamental request states;

prioritizing the active request state variables according to a predetermined schedule;

selecting at least two active request state variables of higher priority than other request state variables in the plurality of request state variables;

combining at least two request state variables to form a combined request state variable that contains active requests in the at least two request state variables;

simplifying the combined request state variable to eliminate any redundant requests and to resolve any conflicting requests;

providing a final request state variable; and
evaluating the final request state variable to determine whether a change in engine state is desirable;

~~The method defined in Claim 2 wherein the step of evaluating the final request state variable includes~~ including
the step of:

transitioning a state machine from an engine off state to an engine on state in accordance with a predetermined relationship of engine request variables fpu, pu, ipu and fpd, which identify an active status or an inactive status of engine requests.

20. (Cancelled)

21. (Currently amended) A method of controlling the on/off state of an engine in a hybrid electric vehicle powertrain comprising the following steps:

generating a plurality of request state variables based on a comparison of vehicle operating conditions and requirements, each variable indicating the active or inactive status of each of a plurality of engine requests, the value of each request state variable being constrained to a set of fundamental request states;

prioritizing the active request state variables according to a predetermined schedule;

selecting at least two active request state variables of higher priority than other request state variables in the plurality of request state variables;

combining at least two request state variables to form a combined request state variable that contains active requests in the at least two request state variables;

simplifying the combined request state variable to eliminate any redundant requests and to resolve any conflicting requests;

providing a final request state variable;

evaluating the final request state variable to determine whether a change in engine state is desirable;

~~The method defined in claim 2 wherein the step of evaluating the final request variable includes~~ including the steps of:

transitioning a state machine from an engine on state to an engine off state in accordance with a first predetermined relationship of engine request variables ~~fpu, pu, ipu and fpd~~ and otherwise maintaining the state machine in an engine on state; and

transitioning the state machine from an engine off state to an engine on state in accordance with a second predetermined relationship of engine request variables ~~fpu, pu, ipu and fpd~~ and otherwise maintaining the state machine in an engine off state, ~~where fpd, pd, fpu, ipd, pu and ipu are the engine request variables, which identify~~ identifying the active or inactive status of engine requests.

22. (Currently amended) The method set forth in ~~claim 20~~ Claim 21 wherein each fundamental request state comprises a 6 bit binary word, each bit identifying whether an engine request state is active or inactive.

23. (Currently amended) The method set forth in ~~claim~~
Claim 21 wherein the step of combining joins two or more request
~~states~~ state variables through a bitwise OR operation.

24. (Currently amended) The method set forth in ~~claim~~
~~22~~ Claim 21 wherein the step of simplifying includes an
arbitration operation that follows the requests according to a
predetermined priority.

25. (Currently amended) The method set forth in ~~claim~~
~~23~~ Claim 21 wherein the engine requests are grouped in
hierarchical levels through the combination and simplification
steps.